Virginia's Forest Resources

Few things invigorate our bodies and minds like a brisk walk through a forest. The panoply of colors, shadows, textures, and shapes soothes the mind and frees the thought process. Just as important, forests beautify the landscape while offering quiet places to observe nature. Forests renew our spirits.

On a practical level, forests moderate climate, help cleanse the air and water, and house wildlife. They also provide thousands of wood products and related jobs.

Virginia's forests are diverse. From the extensive loblolly pine forests of the flat, low-lying Coastal Plain, through the patchwork of pines and hardwood forests of the rolling Piedmont, to the white pine and upland hardwoods of the western mountains and valleys, forests wear many faces.

Forest Ecology

A forest is more than just trees. It is an ecological system made up of all the organisms that inhabit it — from trees to mosses, from birds to bacteria. All are interdependent, and it is the myriad interactions among living components of the forest and surrounding physical environment that keep a forest productive and self-sustaining for many years.

Forests come in lots of varieties. Different tree species dominate at various sites. Some forests are denser and more productive than others, and tree ages vary. In fact, the type of forest that naturally exists at a particular site is the result of many factors, including conditions of the physical environment and the history of disturbance there. Critical factors that shape a forest's character include soil type, moisture, slope, aspect (or exposure), climate, fire, wind, and sunlight.

Forests are also ever-changing. Sometimes the changes are swift, resulting from natural or human forces. Other times these changes are slow, occurring over many seasons. But regardless of such changes, the forest ecosystem continues to function. Processes such as succession, maturation, and decay are continuously at work.

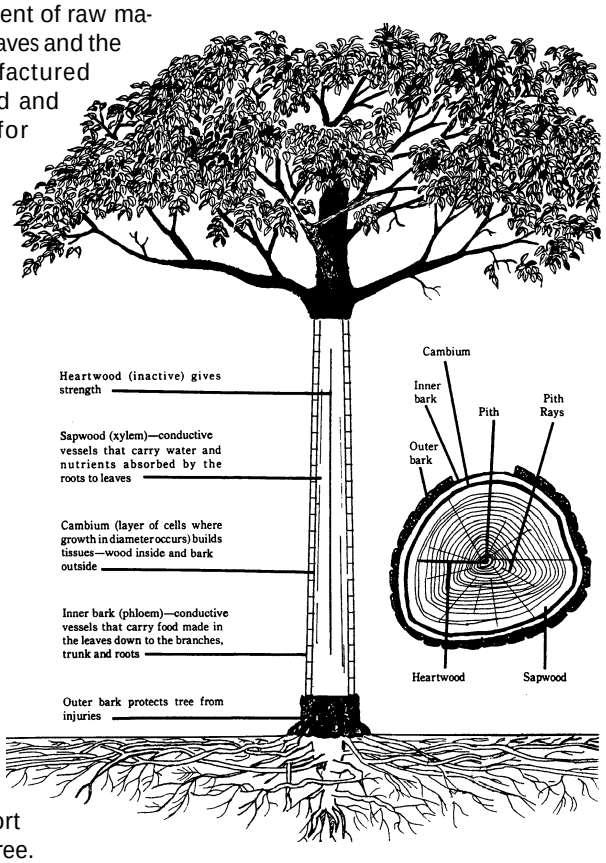
Active management of a forest modifies what occurs naturally on a given site. For example, sometimes we choose to harvest mature trees rather than let them grow old, fall, and decay as they would in the natural cycle. And, when choosing to create openings to benefit wildlife, it is at the expense of birds and plants that live in forest interiors. Each management choice favors some species and enhances

How a Tree Grows

The crown consists of the leaves and branches. The leaves should be called the tree's "chemical laboratory." They contain small green bodies called chloroplasts. Chloroplasts contain chlorophyll, the substance that gives the green color to the leaves. In the presence of sunlight, the leaves use the carbon dioxide from the air to produce glucose and oxygen. The oxygen is released to the atmosphere and the glucose is stored in the trunk and roots. This process is called photosynthesis.

The trunk, or main stem, of the tree supports the crown and contains the conductive vessels that run between the roots and the leaves. These vessels allow the movement of raw materials up to the leaves and the return of manufactured food to the wood and root systems for growth and storage.

The root system is the most important part of a tree, yet is the most frequently ignored. A tree's root system usually extends horizontally beyond the branch tips. The majority of the root system is located in the upper 12 to 18 inches of soil because of the high levels of oxygen which the roots require. Roots absorb nutrients and water, store food, and support and anchor the tree.



some processes at the expense of others.

Diversity of species mix and age keeps a forest healthy, helps reduce insect and disease problems, and benefits a variety of wildlife. Forests are kept healthy and growing through proper management. Occasionally this includes harvesting older trees or forest stands to make room for younger ones. When this happens, primary concern should be to create conditions favorable for the development of a healthy, new stand.

All plants and trees eventually die. As trees die they attract insects which, in turn, become food for birds. Cavities provide shelter for animals such as squirrels, raccoons, and opossums. As wood is further broken down by fungi and bacteria, the organic matter and nutrients are released from the wood and work their way back into the soil. These nutrients are recycled and used by different, competing plants. Nutrient recycling in a forest ecosystem, then, is key to healthy succession.

Virginia's Forest Resources

Nearly all of the natural forests in Virginia have been extensively modified by human activities during the past 300 years. Throughout the Piedmont and Coastal Plain regions, land was cleared for agricultural use in colonial times. Many sites have been harvested or cleared several times since for crop cultivation or pasture, then abandoned to become reforested over several generations.

Hardwood forests currently cover more than 70% of the total forest area of Virginia — over 11 million acres. Hardwoods reproduce abundantly from stump sprouts, roots, or seeds in the soil when exposed to increased light and moisture. Usually, in fact, there is no need to replant seedlings unless a particular species desired does not exist on site.

Pines are mostly pioneer species, meaning they are the first trees to go to seed on bare ground after a fire or in an abandoned field. Like most oak trees, pine seedlings need full sunlight to grow. They cannot tolerate shade. Loblolly pine is the most common species found in the southern part of Virginia. Shortleaf pine and Virginia pine can also be found here, but are more common on old abandoned fields.

Pine trees do not sprout from stumps or roots like many hardwoods. They often germinate from wind-blown seeds produced by mature trees nearby. Many landowners reforest cut-over sites by planting pine seedlings produced from improved seed sources and grown in a Virginia Department of Forestry nursery. The seed sources for these "superior" tree seedlings have been selected and tested through intensive research to grow faster, resist insects and diseases better, and survive better than natural seedlings. Since most pine stands are planted or originate from seeds on bare soil, all the trees in a particular stand are usually about the same age.

Extensive research has dramatically increased the growth potential and range of loblolly pine. Each year over 60 million pine seedlings are planted to reforest cut-over or abandoned land throughout the Commonwealth!

Economic Value of Virginia's Forests

Virginia's forests are comprised of 66% hardwood, 22% pine, and 12% oak-pine mixed. This expansive resource, almost 15.5 million acres of commercially productive woodland, serves Virginians well:

- In 1993, the forest industry was the number one manufacturing industry in Virginia, worth $5.8 billion per year to the state's economy.
- One out of every 7 manufacturing workers—130,000 wage earners—are employed in forest-related industries.
- Forest-related industries are located in every county in Virginia and include 285 sawmills, 178 furniture plants, 7 pulp mills, 7 veneer plants, and 1,100 harvesting contractors.
- Forest resources contribute $7.4 billion annually to Virginia's economy.
- Forests offer many recreational benefits for Virginians while purifying the air and water. These attributes are estimated to be worth another $1.6 billion to the people of Virginia and its economy.

In many parts of the state, soils do not produce good quality hardwoods but will support crops of pine timber. Hot, dry, less fertile sites are best for pine tree growth after timber harvesting is completed. With good management, planted seedlings will often exceed two feet in height growth each year, rapidly outgrowing the hardwood sprout competition.

The Role of Streamside Forests

Forests play a critical role in keeping surface waters clean. Acting as a "living filter," forests capture rainfall, regulate stormwater and stream flow, filter nutrients and sediments, and help prevent erosion. When streams are buffered by surrounding forests, runoff is greatly reduced. Even a narrow strip of trees adjacent to a stream can improve water quality.

Healthy, forested stream corridors, called "riparian buffers," provide much needed habitat for many animals and plants, while moderating water temperatures — critical for many fish and aquatic organisms. Decaying leaves and twigs form the basis of food in the stream system and are used by small organisms and insects that, in turn, become prey for fish. Riparian areas are used as travel corridors. It is here that birds, reptiles, amphibians, and mammals move about, eat, rest, and raise their young.

Forested riparian buffers also enhance the beauty of our waterways. They can slow the spread of wildfires by creating a cooler, wetter zone, and offer shaded relief for recreational activities like fishing, hiking, and bird watching.

Managing for Healthy Forests

Forest management and timber harvesting can be accomplished without harming the soil and water. The key is a well planned project using "best management practices," or BMPs for short. Log roads that allow trucks to neatly enter and exit an area, skid trails where skidders drag logs to an area called a landing to be loaded onto log trucks, and replanting disturbed soil with grass immediately are all examples of best management practices.

In some types of forests, low intensity fires are important to maintaining healthy, dynamic ecosystems. For this reason, foresters and wildlife managers often use controlled, or "prescribed," burning to improve tree planting and habitat conditions. Fire clears the forest of woody debris, providing room for new plants to grow. This new growth becomes food and habitat for many birds and animals. Some plants even depend upon occasional fires for reproduction.

Fire also promotes the release of nutrients from woody material. Phosphorus, potash and other essential nutrients are found in the ash left behind. It is nature's way of fertilizing new plant growth.

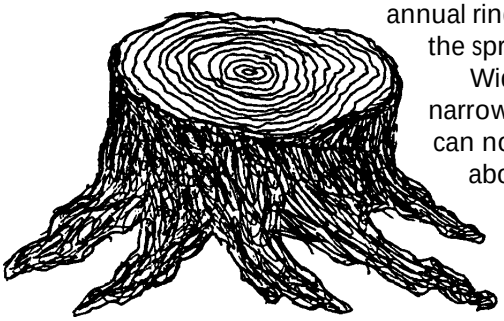
Since the mid-1960s, populations of quail, rabbit, and at least 18 other species with the same habitat requirements have been in decline. Clean farming and more houses creeping into rural areas have contributed to the problem. So it is important that the forests remaining are kept in a state conducive to productive habitat. Prescribed fire by professionals to clear cut-over areas for tree planting and to remove understory brush in older stands helps.

Of the 16 million acres of forestland in Virginia, nearly 75% is owned by non-industrial, private land owners, estimated to be about 300,000 people. State and federal governments own 12% and forest industries own 13%.

Aging a Tree

If you look at a cross-section of a tree trunk, you will see that it is marked by a series of concentric rings. Each growing season, a tree adds a layer of new wood to its "girth," or circumference. During the cold months, when the sap ceases to flow, growth is temporarily halted and the tree rests. Thus, the rings are clearly marked. By counting the rings, it is possible to arrive at a reasonably accurate estimate of the tree's age.

The layer just under the bark of the tree, called the cambium, produces the tree's new wood and bark growth each year. One annual ring consists of the light, spring wood band and the darker, summer wood band. The spring wood (which is softer and more porous) is toward the inside of the annual ring, and the summer (harder) wood is toward the outside -- because the spring wood grew first.



Width of the rings can vary from year to year. Dry seasons produce narrow rings; wet seasons, broad rings. Armed with this knowledge, you can not only approximate the age of the tree, but also draw conclusions about the weather and other natural conditions that influenced growth. For example, what effect would these factors have on a tree's growth: shading by another nearby tree, too many trees growing in one place, diversion of a creek away from the tree roots?

Wildfires (or forest fires) which occur during hot, dry, windy periods can destroy a forest, wildlife habitat, and nearby houses. In Virginia, 99 percent of these destructive fires are caused by people being careless. Each year, wildfires cost hundreds of thousands of dollars to control. Annually, about a thousand fires burn 4,000 acres of forest land. In addition to destroying the timber, hot fires wipe out the cover on the forest floor, leading to erosion during storm events.

For over 50 years, Smokey Bear has been the symbol of forest fire prevention. Smokey reminds us that, "Only YOU can prevent forest fires." Most fires can be prevented by using common sense, following safety rules, and obeying fire laws. Smokey's rules include:

- Never leave a fire unattended.
- Don't play with matches.
- Drown your campfire "dead out."
- Clear a 10-foot safety circle of leaves and dry grass.
- If your home is in or near the woods, have a fire safety inspection done by a forest warden or fireman to be sure you are fire-safe.

Forest wardens and volunteer firemen work together to control forest fires and save lives, properties, and forest resources. Forest wardens investigate all forest fires to find the person responsible, collect "suppression" costs, or issue a summons to court for violations of the law.

Insects and Disease

More trees are killed each year by insects and disease than all other causes combined. These naturally occurring forest pests can devastate large areas of a forest (such as what was experienced with the Gypsy Moth and Southern Pine Bark Beetle) or individual trees around your home (familiar culprits include tent caterpillars and bagworms). Many insect and disease problems can be minimized by simply managing the trees to maintain their vigor and health.

When trees reach maturity, their growth and vigor decline, particularly in unmanaged stands where competition for limited resources can be severe. Well managed stands will stay healthier longer. Forests with mixed ages and species are far less likely to sustain pest outbreaks than pure, even-aged stands. Recognizing pest problems early and seeking advice from a professional forester can often help reduce or prevent tree losses.

Conserving the Forest Land Base

One of the greatest threats to our forests is not wildfires, insects, or diseases, but the conversion of forest lands to other uses. Fragmentation of large land parcels occurs when they are broken into smaller blocks for houses, roads, and other uses—sought by a swelling population base. Forest fragmentation is on the rise, and it limits the options for both management and production. It threatens those wildlife species needing a sizeable habitat free of constant disturbance and human competition. Fragmentation also threatens the vitality of Virginia's natural landscape—the backbone of the tourism industry.

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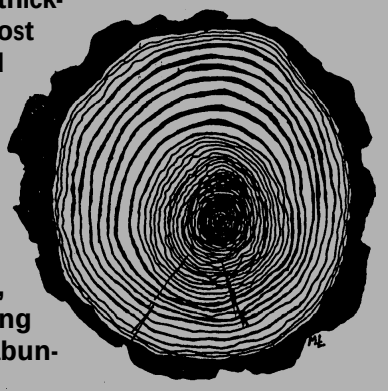
Responsible, sustainable forest management and forest conservation measures are needed now in Virginia. Such measures would complement comprehensive land use planning, and should be based upon the most recent assessment data and scientific research available. Wise stewardship will ensure that Virginia forests continue to provide us with the many aesthetic, economic, environmental, and cultural benefits that daily improve our quality of life.



Cross-section of a loblolly pine, showing the effect of light upon annual ring thickness. The innermost rings were formed while the young tree was densely shaded. Outer rings show increased width following removal of adjacent trees, allowing the young pine to receive abundant light.

The Value of Forested Riparian Buffers

Streamside, or riparian, forests make excellent buffers between upland areas and waterways. Studies have shown dramatic reductions in nutrients (nitrogen and phosphorus), sediments, pesticides, and other pollutants in surface and ground water after passing through a forest buffer. Riparian forests freely support the many economic benefits of clean water (versus the costs of repairing damaged and degraded natural systems) by performing the following functions:

r **Trapping Sediment & Maintaining Stream Integrity:** Studies indicate that an urban stream system may fail to function if 10% or more of the land in its watershed is covered by paved or impervious surfaces, resulting in a system that silts downstream areas and increases flood potential. Riparian forests filter sediment from stormwater *before* it reaches waterways and help maintain stream integrity.

Repairing streams is expensive! In urban Fairfax County, a local bond issue provided nearly $1.5 million to restore 2 miles of degraded stream and riparian area. That's about $750,000 per mile.

r **Nutrient Removal:** Adequate riparian forest buffers can reduce costly water treatment to remove pollutants like nitrogen and phosphorus.

An acre of riparian forest buffer can remove an estimated 21 lbs. of nitrogen each year for $0.30 per pound and about 4 lbs. of phosphorus every year for $1.65 per pound.

❒ **Erosion Control:** Erosion and sediment control is costly to communities both during development and in maintenance down the road. Trees provide deep root systems that hold soil in place, stabilizing streambanks and floodplains and reducing erosion.

Average costs for subdivision development include clearing of the forest (at $4,000 per acre) and sediment control (at $800 per acre). Forest conservation keeps soil on site, resulting in less time and labor to re-grade, stabilize, and re-landscape the site.

❒ **Flood Protection:** When floods pass through a forested stream corridor or floodplain, the roughness of the forest and its lush vegetation help to reduce the energy of the water flow and thereby reduce downstream flood damage. Forests also serve as a storage area for stormwater, absorbing and slowly releasing water to a stream or under ground.

Retaining forest area and buffers has been estimated to reduce stormwater costs in Fairfax County by $57 million.

❒ **Wildlife Habitat:** Habitat diversity provided by trees, shrubs, and grasses makes riparian forests critical to the life stages of over half of all native Chesapeake Bay species. Organic matter produced by riparian trees is the foundation of the food web in most stream environments.

Tourists and residents place a high value on wildlife watching. Studies confirm that a majority of suburban residents are willing to pay greater prices for homes in settings that attract wildlife.

Source: Chesapeake Bay Program.

Trees for Good Health

t Trees help relieve stress associated with living in cities. Medical research indicates that patients in rooms with a view of trees get better faster.

t Trees can reduce air conditioning needs by 30 percent, and used as windbreaks, trees can save 20 to 50 percent in energy used for heating.

t Trees reduce noise pollution by absorbing unpleasant sounds.

t People shop longer along tree-lined streets and apartments, and offices rent more quickly in wooded areas. Trees can add 10 percent or more to a property's value.

t Trees improve air quality by trapping and holding dust particles that can damage human lungs. Tree leaves absorb carbon dioxide and other poisonous gases and, in turn, replenish the atmosphere with oxygen for us to breathe. (One acre of trees provides oxygen for 18 people.)

Additional Resources

Web Sites:

u Virginia Department of Forestry; www.dof.state.va.us

u FORsite (Forestry Outreach Site for middle schools); www.fw.vt.edu/dendro/forsite/welcome.htm

u 4-H Tree Identification Project Guide; www.fw.vt.edu/4h/

u Virginia Big Tree Program; www.fw.vt.edu/4h/bigtree/index.htm

u Forestry and Wildlife Clubs; www.ext.vt.edu/resources/4h/environment/forestry/forestry.html

Other Resources:

u Virginia Department of Forestry has fact sheets and materials on a range of topics, and a new CD that allows the user to take a *virtual walk* in the woods; available from DOF headquarters by calling (804) 977-6555 or on-line (see above).

u Virginia Tech (VPI&SU), College of Forestry and Wildlife Resources, (540) 231-5481.

Fundamental Learnings Related to Forest Resources

R Forests are a renewable natural resource of tremendous value to people for providing environmental, economic, and cultural benefits essential to our quality of life.

R A forest ecosystem is an interactive community of plants, animals, and microbes which is dynamic and ever-changing over time either as a result of human activities or by natural forces such as succession, mortality, decay, weather, fire, insects, and disease.

R Using wise stewardship management practices, healthy forests with a diversity of forest stand types and ages can be created that sustain wildlife habitat, clean water, and fresh air, and provide recreation opportunities, wood products, scenic beauty, and spiritual renewal.

R Each tree species has a range of tolerance for basic environmental factors that control its survival—including sunlight, water, temperature, and nutrients. Forest managers apply these basic ecological principles to manipulate or control natural changes and reactions to planned "disturbance" activities.

R Fire in a forest can be good or bad depending upon how and when it is used. In the proper time and place and under the right conditions, controlled fire can be used by a trained professional resource manager to improve forest health and enhance wildlife habitat.

R Private landowners own 75% of Virginia's forestlands. Forest areas are getting smaller and more fragmented due to increasing development. The greatest threats to our forest resources are population growth and unplanned development.

R A timber harvest is not the end of the forest but, rather, the beginning of a new, young, vigorous forest. A timber harvest is disruptive, but does not need to be destructive. A professional natural resource manager should always be contacted for assistance before any timber is harvested.

R The way we care for our forests today will determine what types of forests we will have in the future.

We All Need Trees

Adapted from Project Learning Tree ©1993

Summary

In this activity students will discover the diversity and multitude of products that are in some way derived from trees.

Concepts

*Successful technologies are those that are appropriate to the efficient and sustainable use of resources and to the preservation and enhancement of environmental quality.

*Natural beauty enhances the quality of human life by providing artistic and spiritual inspiration as well as recreational and intellectual opportunities.

Question

Many items we use everyday come from trees. However, many tree products are not obvious. Which products come from trees? Are there substitutes for some of these products? Is the substitute reusable or recyclable? Was the original forest product reusable? Is the substitute made from a renewable or nonrenewable resource?

Background

A wide variety and number of products we use every day are in some way derived from trees. However, many tree products are not obvious. Products are derived from all parts of the tree. Wood is the most obvious in such things as lumber for houses, furniture, doors, picture frames, floors, fences, boats, paddles, crates, spools for thread, cabinets, broom handles, toothpicks, and baseball bats. Cellulose is the major component of wood and is the source of paper and paper products, including books, cereal boxes, magazines, newspapers, food labels, toilet paper, coffee filters, stationery, grocery bags, egg cartons, and paper towels. Besides being used to make paper, cellulose is an ingredient in many other products. Paper mills use cellulose from three sources: recycled paper, wood chips, and sawdust left over from making lumber and raw logs. Cellulose can be mixed with certain chemicals and squeezed into fibers that are used to make carpets, wigs, fabrics such as rayon for clothes, and furniture.

Cellulose is also used as a key ingredient in cellophane, sausage casings, explosives, toothpaste, shatterproof glass, sponges, shampoo thickeners, imitation leather, photo film, and many other products. Cellulose may also be used to produce molded plastics for eyeglass frames, telephones, Walkmans, buttons, hairbrush handles, steering wheels, pipes, toys, counter tops, and packaging such as bubble covers on consumer products. It would be hard to find a part of the tree that people cannot use in some way. The bark of many trees is used for many different products, such as soil conditioners, fuel, mulch, and waxes for cosmetics, shoe polish, and cars.

Some trees produce saps called gums and resins that are used to make paint thinner, chewing gum, medicines, soaps, floor polish, crayons, perfume, printing inks, insecticides, disinfectants, and fireworks. The sap from the

Grade Levels: 4-6

SOLs:
Science 4.8, 6.11
English 4.1, 4.2, 5.1, 6.1

Materials:
Copy off student pages for each team. Collect as many of the following items as you can and label each one with a number:

- **Newspaper**
- **Toothpicks**
- **Candy bar with almonds**
- **Piece of wood**
- **Tissue paper**
- **Synthetic sponge**
- **Piece of rayon fabric**
- **Baseball**
- **Bottle of vanilla flavoring**
- **Book or magazine**
- **Pack of chewing gum**
- **Bottle cork**
- **Rubber gloves**
- **Apple**
- **Walnut**
- **Plastic comb or brush**
- **Piece of cellophane**
- **Piece of furniture**
- **Toothpaste**
- **Shampoo**
- **Coffee filter**
- **Wig**
- **Ink**
- **Film (negatives can be used)**
- **Film canister**
- **Buttons**
- **Plastic toy**
- **Soap**

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rubber tree was extracted for hundreds of years to make products such as rubber-soled shoes, gloves, and containers.

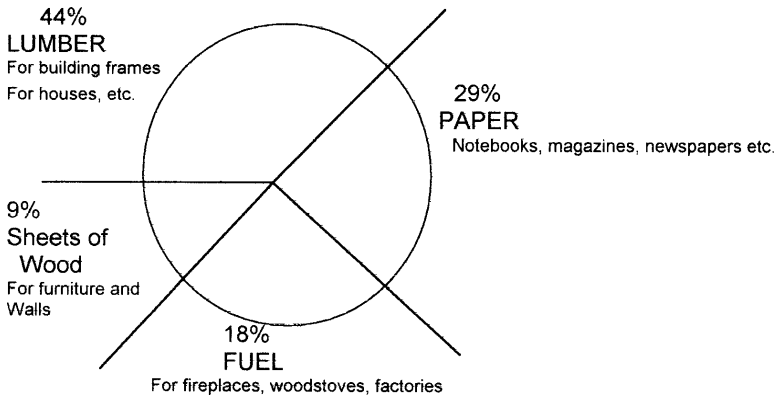
Maple trees produce a sap that people turn into maple syrup. Trees provide fruits and nuts such as apples, coconut, pecans, lemons, and olives, and spices such as allspice, nutmeg, and vanilla. Tree leaves, trunks, roots and other parts also provide ingredients for paints, road-building materials, medicines, tea, adhesives, inks, tar, charcoal, and hundreds of other products.

One cord of wood (that is a pile of wood 4' by 4' by 8') can make:

* 7,500,000 toothpicks, or
* 1,000 pounds of paper, or
* 942 one-pound books, or
* 4,384,000 postage stamps, or
* 61,370 business size envelopes, or
* 460,000 personal checks, or
* 30 rocking chairs, or
* 12 dining room tables big enough for eight people

How We Use Wood in the United States

We use trees in many ways in our daily lives. If you used a pencil today, sat on a wooden chair, read a newspaper, poured cereal from a box, or brushed your teeth, you've had contact with a tree. The average American uses each year the equivalent of one tree, 100 feet tall and 16 inches in diameter, to fulfill their wood and paper needs. In the U.S. we use wood in the following way:



How We Use Paper in the United States		
44%	Paperboard	For cereal boxes and other cardboard
30%	Printing and writing	Homework, office paper, books, magazines
14%	Newsprint	For newspapers
7%	Tissue	For tissues and toilet papers
5%	Packaging	

Objectives:
Upon completing this activity, students will:
1. Examine various products and deterine which ones are from trees.
2. Describe the ways trees are used to make products.
3. Explore methods for recycling and reusing products.

Skills:
analyzing
classifying
categorizing
interpreting

Vocabulary Words:
cellulose
conifer
latex
pulp
Quinine
resin
silviculture
tannin

Procedure

1. Place the items you have collected around the room and label each one with a number.
2. Divide the group into teams of four and tell them that team members will work together to determine which of the products around the room are made from trees. All team members must agree with the team's decision about each product and must be able to explain why each product is on their list.
3. Have the students number themselves from one to four. Tell all the "1s" that it's their responsibility to record the information that everyone agrees on and then report their group's findings to the rest of the class. Tell all the "2s" that they must make sure that everyone in the group has an opportunity to speak as the team tries to reach decisions. The "3s" must make sure the group stays on track and gets everything accomplished in the time allowed. The "4s" are the only people who may leave the group to ask questions.
4. Have the teams move around the room and examine the products. After they have decided if an item comes from trees in some way, they should record it on a list and move on to the next one.
5. Once teams have established their lists, give each team a set of the student readings. Each student should read the article that corresponds to his or her number. (Student pages can be cut in half.)
6. After reading the articles, students should explain the contents to their team members. Each person is responsible for making sure everyone understands the articles.
7. The teams should then re-evaluate the list of products they decided came from trees. Are there any products they want to add or delete from their list? Everyone on the team must agree with the changes and should be able to explain why each item is on the list.
8. Have the teams share their lists with other groups. Discuss the diversity of products we get from trees. Students should realize by the end of the activity that all of the products around the room came from trees in some way.
9. How will this new awareness of forest products affect student's lifestyles? Will they make any changes? ***Discuss*** conservation practices such as recycling, reusing, or reducing use.

Extension

Have students work in their groups to brainstorm a list of ways they use paper. Have them write down three or four items on their list that they think are the most important. Then have them write down possible substitutes. Compare the environmental and economic factors associated with each. They may need to research some of the substitutes. Have them answer the following questions:

1. Are there substitutes for some of these products?
2. Is the substitute reusable or recyclable?
3. Was the original forest product reusable?
4. Is the substitute made from a renewable or nonrenewable resource?
5. What, if any, are the long-term implications for continuing to use these paper products or their substitutes?

Assessment

A scavenger hunt for tree products is a fun way to assess students' concepts and information presented in this activity. The scavenger hunt can be done in school, outdoors, or in a supermarket or drug store.

1. Organize students into groups of three.
2. Provide each group with a list of items such as these to find:
    * Two products from the gum of trees (rubber products, chewing gum)
    * Two products from wood (furniture, toothpicks, spools)
    * Two products from fruits and nuts (cider, spices, pecan, apples)
    * Two products from resin (soap, varnish)
    * Two products from leaves or bark (cork, mulch, tea)
3. Challenge student to find items that are not obvious tree products.
4. Have the students share their discoveries and explain which part of the tree each product is from.

STUDENT PAGE°

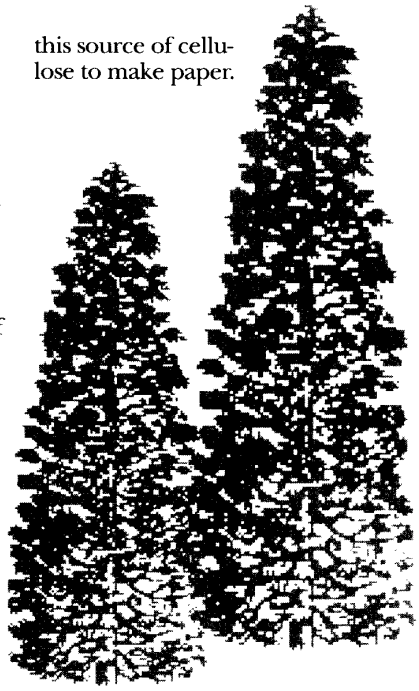
TREE READINGS

1 Look around you and chances are you'll see a lot of things made out of wood. People use wood to build houses and other buildings; to construct doors, floors, fences, and furniture; and to make many other products including bowls, boats, paddles, crates, baskets, and baseball bats.

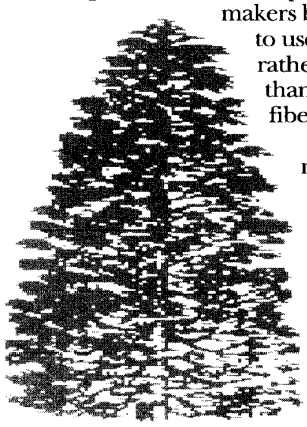
To make wood products, you must first harvest trees and process them into lumber. In sustaining a renewable supply of timber, forest managers practice silviculture—the management and cultivation of forests. Young trees are usually re-planted or naturally re-seeded on the land where they were harvested. Openings created by harvests often improve the habitat for certain wildlife species.

After the trees have been cut down, the branches are removed, and they are cut into logs. Then, the logs are loaded onto trucks and transported to a sawmill. The first machine at the sawmill strips off the bark. The logs are then measured and then cut into lumber. Depending on how the wood will be used (whether for buildings, furniture, baseball bats, etc.), the trees will be cut in different ways. What products a tree is used for depends on the type of tree it is. For example, hardwood trees such as oak and maple are often used for flooring and high-quality furniture, while softwood (coniferous) trees are usually used for papermaking, lower-quality furniture, houses, and crates.

Plants contain a compound called cellulose to give them rigidity and support. Cellulose is the main component in wood and, in most cases, people use this source of cellulose to make paper.



2 Paper was made by hand for nearly 17 centuries following its invention in China about 100 A.D. In the Orient, plant fibers were beaten into a pulp, suspended in water, and formed into sheets by draining the fibers through a screen. As knowledge of papermaking moved westward, papermakers began to use rags rather than plant fibers to furnish pulp.



Papermaking spread to Europe through the Middle East, reaching Spain from North Africa by about 1200. From Spain, the craft eventually was brought to the New World. The Spanish established a European-style paper mill in Mexico in about 1580, but little is known of that endeavor, and it did not mark the beginning of continuous production.

Paper mills use cellulose from three sources: recycled paper, wood chips and sawdust leftover from making lumber, and raw logs. When raw logs arrive at the mill, machines strip the bark off and chop the trees into chips. Then the chips (and other sources of cellulose) are "cooked" with chemicals until the mixture becomes a thick pulp.

Next, the pulp is "washed." During the washing stage, dirt and other impurities are filtered out, producing clean pulp and, leftover waste and solids called sludge water. The sludge is separated from the water and either landfilled, burned, or applied to the land as fertilizer. The wash water goes into a waste water treatment system. The clean pulp then goes through a series of machines where the fibers get mashed apart so that the pulp will form smooth sheets when dried.

Eventually, the pulp is run onto screens where the water drains off, and the result is newly formed paper. The paper is compressed and dried. Depending on the chemical process used to refine the pulp and the amount of cleaning and flattening involved, people create different kinds of paper such as coffee filter paper, heavy writing paper, wrapping paper, and so on. They can also create cardboard, boxboard, paperboard, and other strong products.

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TREE READINGS

3 All land plants contain a compound called cellulose, which provides them with rigidity and support—it's the number-one component in wood. People use cellulose from wood to make a variety of products besides paper. For example, cellulose can be mixed with certain chemicals and squeezed into fibers that are used to make carpets, wigs, and fabrics such as rayon for clothes and furniture. Cellulose is also used as a key ingredient in cellophane, sausage casings, explosives, shatterproof glass, sponges, shampoo thickeners, imitation leather, and many other products. Processed with certain chemicals, cellulose may also be used to produce molded plastics for eyeglass frames, hairbrush handles, steering wheels, and so on.

4 It would be hard—if not impossible—to find a part of a tree that people do not use in some way. The bark of many trees, for example, is used for many different products. Most bottle corks are made from the bark of cork oak trees, which grow in Europe and Africa near the Mediterranean Sea. The spongy bark of these trees is made into bulletin boards, the inner cores of baseballs, and many other products. Quinine, the drug used to cure and prevent malaria, comes from Peruvian bark and had been used by Native Americans long before the Europeans arrived. Some tree bark has an abundance of a chemical called tannin. People use tannin to process leather.

Some trees produce saps called gums and resins that are used to make paint thinner, chewing gum, medicines, and many other products. For hundreds of years, South American Indians have extracted the sap or latex from the rubber tree to make products such as rubber-soled shoes and containers. They processed it by heating the rubber and mixing it with sulfur to improve its strength. Maple trees produce a sap that people turn into maple syrup. Trees provide people with fruits and nuts such as apples, coconut, pecans, lemons, and olives, and spices such as allspice and nutmeg. Tree leaves, trunks, and other parts also provide ingredients for paints, road building materials, medicines, artificial vanilla, adhesives, inks, and hundreds of other products.

Parts of a Tree